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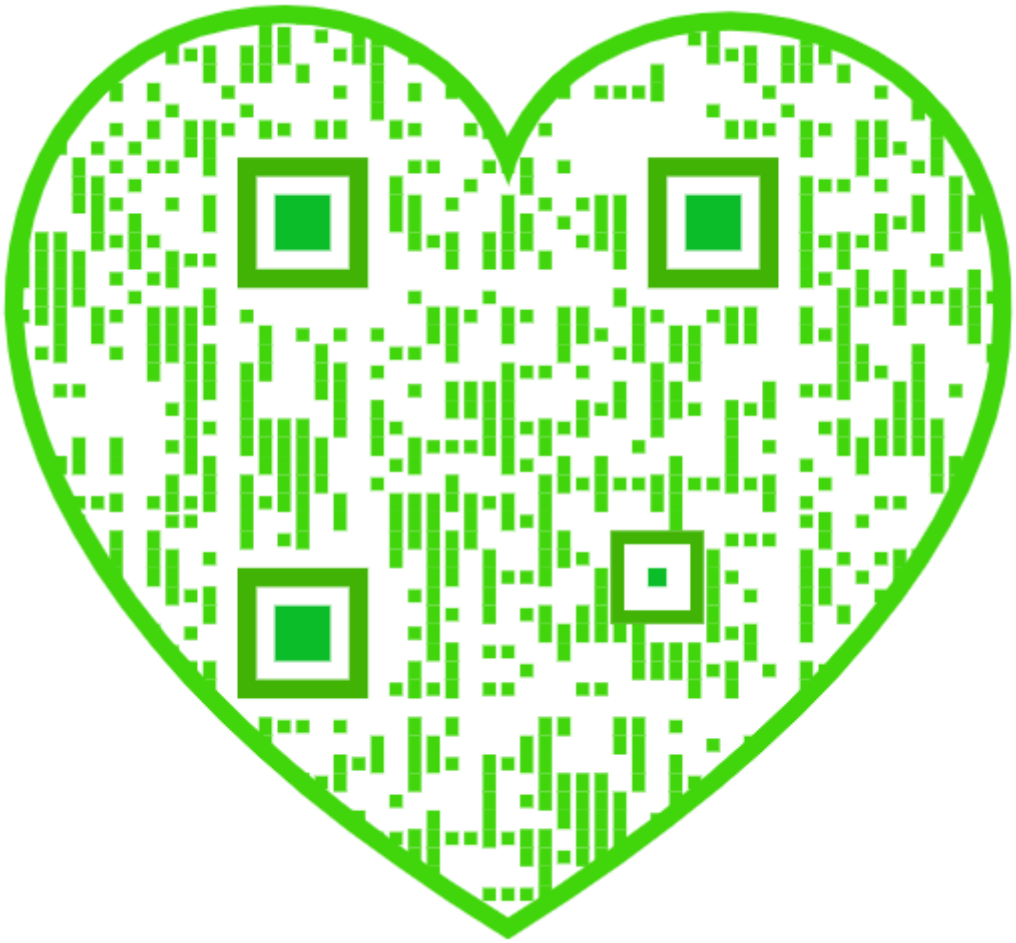
UTILIZATION OF FLUE-HEATED TOBACCO BARNS FOR SWEET-POTATO STORAGE



THE STORAGE OF SWEET POTATOES is a practice that has attained considerable importance.

If some building which is intended primarily for another purpose can be remodeled so as to serve for the keeping of sweet potatoes, there is an opportunity for a material saving in the cost and number of farm buildings.

Such a practice is possible in regions where flue-heated tobacco barns are to be found, as the curing of the tobacco is over before the harvesting season for sweet potatoes.

This bulletin contains directions for remodeling these structures so they can be used for the dual purpose.

The cost of the necessary modifications is small, and the changes do not impair the structures for their primary use.

Contribution from the Bureau of Plant Industry

WM. A. TAYLOR, Chief

Washington, D. C.

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UTILIZATION OF FLUE-HEATED TOBACCO BARNS FOR SWEET-POTATO STORAGE.[1]

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POSSIBILITIES OF SWEET-POTATO STORAGE.

WITH the steadily growing necessity of more satisfactorily husbanding the perishable food crops produced in the United States, the importance of adequate storage for the sweet-potato crop becomes more important. It is only within recent years that the main sweet-potato producing territory of the country has been equipped with sufficient storage facilities for conserving more than a small fraction of the total production. Through the use of the modern storage house and the proper curing of the crop at harvest time a very considerable part of the total production is now annually made available for human consumption, though much yet remains to be accomplished.

The construction of special houses for the purpose of storing sweet potatoes is a matter to be taken into consideration where there are but a few hundred bushels or not more than a thousand bushels of sweet potatoes to be stored. If some building which serves another important purpose can be remodeled into a sweet-potato storage house so as to serve a dual purpose, there is a possibility of a mate-

[1] The experimental work on which this bulletin is based was carried on by the Bureau of Plant Industry in cooperation with the Pee Dee Experiment Station, Florence, S. C. Credit is due Mr. R. E. Currin, of that station, for supplying the equipment used in conducting the work and for his assistance in planning and carrying out the details of the experiments.

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rial saving in the cost of farm buildings and at the same time an opportunity to conserve at the smallest possible outlay of cash an increased supply of sweet potatoes. Many growers who produce less than a thousand bushels of sweet potatoes figure that they can not afford to build a storage house and so are content to take the risk of storing their sweet potatoes in banks.

On farms which have flue-heated tobacco barns or other outbuildings of similar character which serve their primary use at a season before the sweet-potato harvest and are not needed for other purposes during the period covered by the curing and storing of sweet potatoes, a decided saving in the cost of construction can be made by

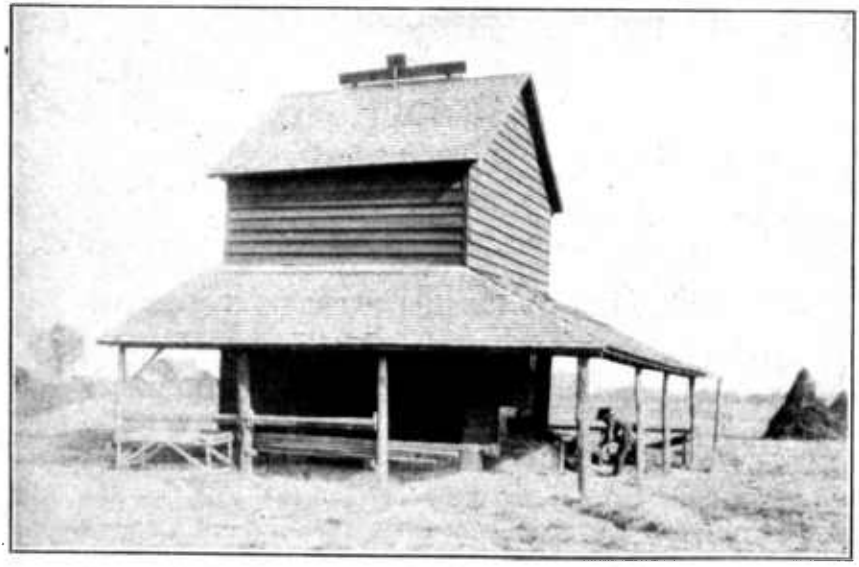

FIG. 1.—A 16 by 16 foot tobacco barn at the Pee Dee Experiment Station, Florence, S. C., which with slight modification served during the season of 1919–20 for curing tobacco from July 15 to September 1 and for sweet-potato storage from November 7 to March 25.

modifying these structures so as to serve a double purpose. In tobacco sections in sweet-potato territory where flue curing is practiced there are many tobacco barns which have the necessary equipment for providing the heat for curing sweet potatoes at harvest time that need only slight modification to become satisfactory sweet potato curing and storage houses. (Fig. 1.) The brief period for which these curing barns are used is well in advance of the harvest of sweet potatoes, and the modification which is necessary in order to make them satisfactory storage houses for sweet potatoes need not interfere with their use as tobacco-curing barns. If not used for the storage of sweet potatoes such buildings usually stand idle during a large part of the year.

IMPORTANCE OF GOOD STORAGE.

The old practice of storing sweet potatoes in pits, banks, or cellars built under ground is very unsatisfactory, as 40 per cent or more of such roots may be lost from decay. Those which do not decay are, as a rule, of poor quality and do not keep well after their removal. Furthermore, it is not economical to store sweet potatoes under such conditions, as it requires more labor to build banks annually than is necessary to store the potatoes in a properly constructed storage house. The saving in labor would in a few years offset the cost of remodeling

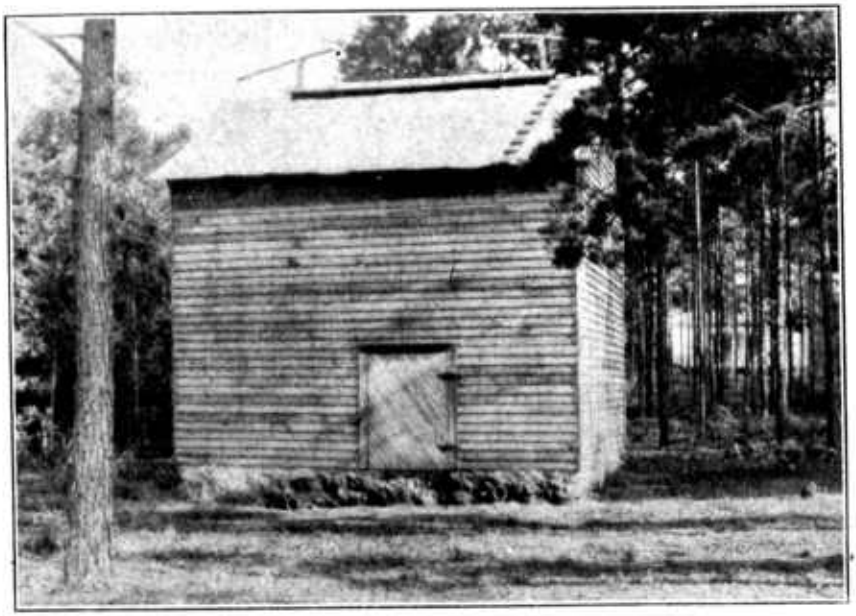

FIG. 2.—A 20 by 20 foot tobacco barn in North Carolina which was used for curing tobacco in 1921 during July and August and for sweet-potato storage in the autumn. The 8-inch tiles in the foundation provide floor ventilation.

the tobacco barn, as suggested in the following pages. Since it is not practicable to open such storage pits in cold or rainy weather it is oftentimes impossible to avail of the best opportunity for disposing of the crop.

The remedy for this condition of affairs is to put the potatoes in a storage house where they can be properly cured and cared for during the storage season and taken out at any time without fear of subjecting those remaining to unfavorable weather conditions.

To keep sweet potatoes in good condition they must be (1) well matured before digging, (2) carefully handled, (3) well dried or cured after being put in the house, and (4) kept at a uniform temperature after they are cured.

TYPES OF FLUE-HEATED TOBACCO BARNS.

The construction of a flue-heated tobacco barn is similar in principle to that of a sweet-potato storage house. The walls of both houses are double, or air tight, and so constructed that the influence of the outside temperature can be reduced to a minimum. Both have provision for roof and floor ventilation and are equipped with heating devices (fig. 2).

Tobacco barns are usually built in two sizes, 16 by 16 feet, with a 16-foot wall, or 20 by 20 feet, with a 20-foot wall. The plan of construction is shown in figure 5. In many cases the log barn is used, where logs or poles are notched at the ends in old log-cabin fashion and

FIG. 3.—A typical log tobacco barn, showing the operator in the act of replenishing his fires.

made tight by "chinking" or "daubing" with mud, or, better, with plaster made in the usual manner for plastering houses. (Fig. 3.) Either the frame or log barn can be used for sweet-potato storage, as both types of houses are heated by a furnace, with 12 or 14 inch flues extending into the house, as shown in figure 4. This method of heating can be used satisfactorily for curing sweet potatoes; also during the storage period when it is advisable to raise the inside temperature.

CONVERTING A 16-FOOT TOBACCO BARN FOR SWEET-POTATO STORAGE.

After the tobacco-curing period is over it is well to get the barn in shape for storing sweet potatoes, in order that everything will be in readiness at the time of the sweet-potato harvest.

In the first place, the furnace and flues should be gone over and made tight. Remove the tier poles to the height of 10 feet from the top of the foundation. These poles should be laid aside until the house is again used for curing tobacco.

INSIDE WALL.

With a frame barn, if the inside wall (fig. 5) is not present, seal over the studding with matched lumber from the foundation to the

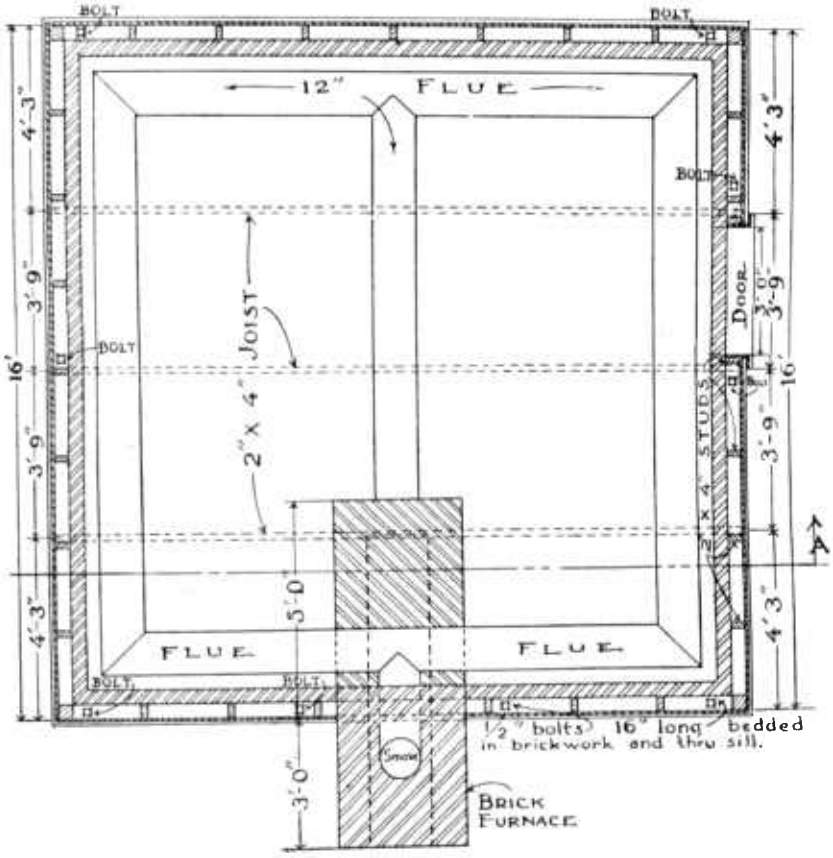

FIG. 4.—Ground-floor plan of a single-frame tobacco barn, showing the arrangement of the furnace and flues; also the foundation and side walls.

top of the storage wall or first row of tier poles. This inside wall should fit tight at the foundation. At the top the openings between the studding and the outer and inner walls should be covered, in order to prevent circulation between the walls and to make this as nearly as possible a dead-air space. Many tobacco barns have this inner wall of matched lumber, which greatly reduces the cost and the time required for converting the barn the first year. It is not necessary to seal the inside of a log barn, but the walls should be gone over to

make sure that the mud or plaster between the logs is tight and secure.

FLOOR AND FLOOR SUPPORTS.

Two piers of the height of the foundation are evenly spaced on a center line on the inside. One girder 4 by 6 inches by 16 feet rests at

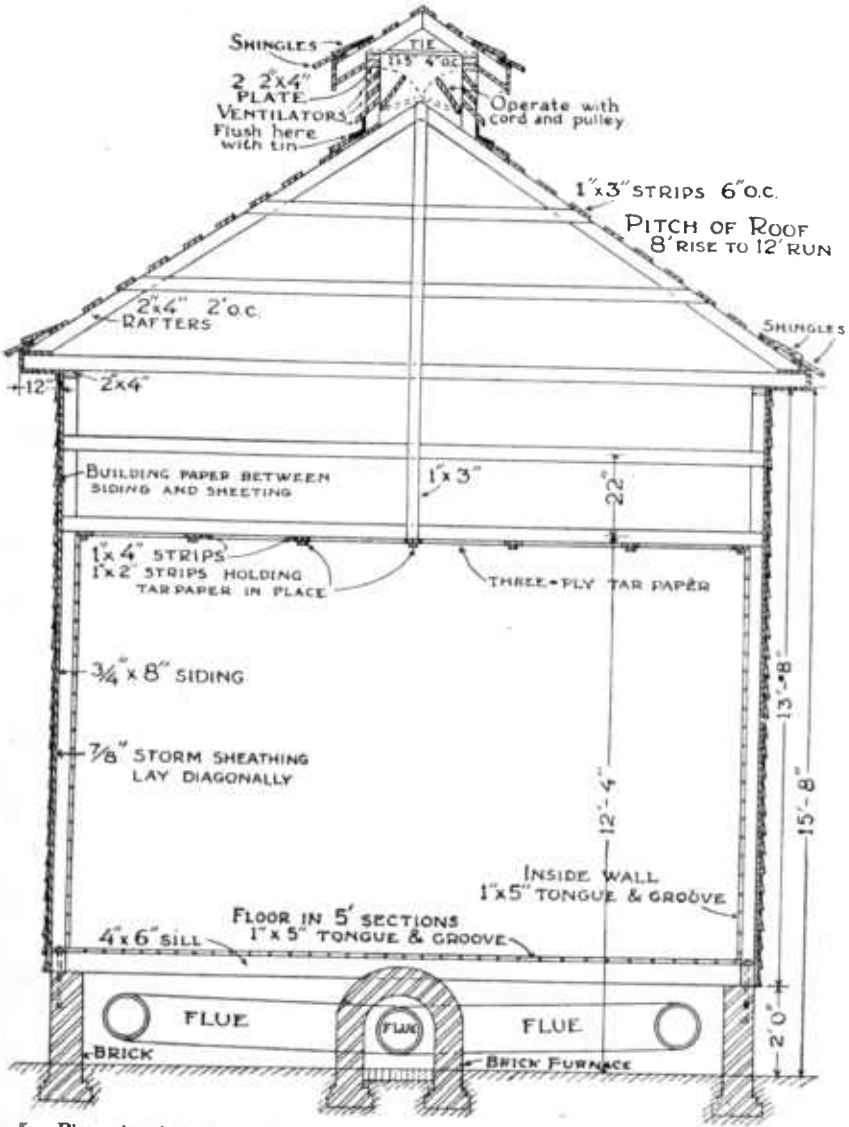

FIG. 5.—Plan showing the end of a frame tobacco barn when converted into a sweet-potato storage house.

each end of the foundation wall and is supported in the center by the two piers. Seven joists, 2 by 8 inches by 16 feet, placed 2 feet apart at right angles to the girder, rest on the foundation at the ends and the

girder in the center. The floor is constructed of 1 by 5 inch tongue-and-groove flooring and is made in 4 by 14 foot sections, so spaced that it fits tight over the joists. The last sections put in should be jammed down in order to make a tight floor. No parts of the floor, joist, or girders are nailed, but are simply made to fit evenly so as to be removed easily. It may be necessary, however, to hold the girder and joist in place by tacking the ends.

CEILING.

Nail 1 by 4 inch strips on the under side of the tier poles, spaced 34 inches apart on center. Use 3-ply tar paper and tack to the under side of the strips, holding it in place by half inch by 2-inch strips. Use a strip for fastening the ceiling tar paper against the side walls in order to make them tight.

VENTILATORS.

If the tobacco barn is not already fitted with wall ventilators make six openings, each about 18 by 24 inches, three on either side between the temporary floor and the ground, and provide these with sash or doors.

Cut a 12 by 12 inch ventilator in each corner of the floor and one in the center. Provide tight-fitting covers for them. Cut two 12 by 12 inch ventilators in the tar-paper ceiling; build a frame around them in order to provide a cover. Space the ceiling ventilators 6 feet from the side wall on a center line.

The door should be made tight, doubled if necessary, and also padded.

It is advisable to cut a small window with a tight-fitting shutter above the door in order to furnish light for working inside during cold weather. Great care must be exercised in making all openings tight, as success depends on tight walls in order to control the inside temperature.

BILL OF MATERIALS.

The following is the bill of materials for converting a 16 by 16 foot tobacco barn at the Pee Dee Experiment Station, Florence, S. C., where it was necessary to add an inside wall:

For piers: One 4 by 8 inch by 6 feet (two piers).

For girder: One 4 by 6 inch by 16 feet.

For joists: Seven 2 by 8 inch by 16 feet.

For flooring (including 20 per cent waste): 300 feet of 1 by 5 inch, tongue and groove.

For inside wall (including 20 per cent waste): 768 feet of 1 by 5 inch, tongue and groove.

For ceiling: Five 1 by 4 inch by 16 feet; five half inch by 2 inch by 16 feet (for fastening tar paper to the tier poles); 2½ rolls of 3-ply tar paper.

Miscellaneous: One 4-light window sash; two pairs of 6-inch strap hinges for a window shutter.

The cost of material for converting the tobacco barn into a sweet-potato storage house amounted to $71.03, figuring lumber at $45 per M. The labor required in this special case was two men's time for a period of 2½ days. This work can be done by the average farm laborer, thereby cutting down the expense. After the first year the cost amounts only to the labor required in converting the barn, as the walls remain permanent, and the ceiling, floor, and floor supports can be removed easily and used indefinitely for several years.

STORING IN CRATES AND BINS.

In this experiment both crates and bins were used, although the crates were preferred on account of ease in handling.

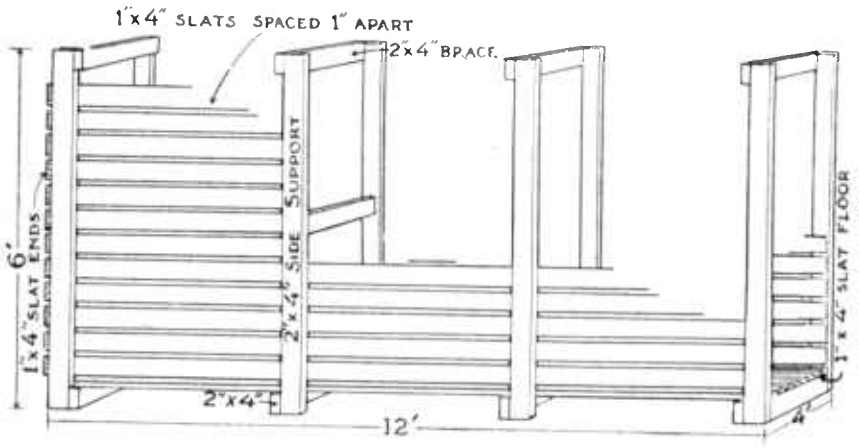

FIG. 6.—Diagram showing the construction of a bin for storing sweet potatoes in a tobacco barn.

Where crates are used, a slat floor raised 4 inches from the main floor should be provided in order to allow air circulation under the crates, and they should be stacked in even rows on it to the height of 8 feet. A satisfactory method is to stack each row of crates on two 2 by 4 inch pieces set on edge, parallel to each other, and about 1 foot apart, thus permitting ventilation under the crates and acting as a substitute for the slat floor. This is important in order to protect the potatoes in the first row of crates.

In case bins are used, it is hardly possible to construct an upright one in sections so that the same can be quickly put together and taken down, but a satisfactory bin can be constructed as shown in figure 6. The sides, floor, and end of this bin can be made separate and held together by cleats.

Results during the season of 1919 and 1920 in storing sweet potatoes in modified tobacco barns at the Pee Dee Experiment Station show that in the bin, during the storage period from November 10, 1919, to March 25, 1920, the percentage of shrinkage amounted to 11.2, while that of decay was 4.75. With crates, during the storage period from November 7, 1919, to March 24, 1920, the percentage of shrinkage was 7, while the decay percentage was 1.7.

STORAGE-HOUSE MANAGEMENT.

HARVESTING.

Sweet potatoes should be harvested as soon as mature and before hard frosts occur, for if left in the ground they are liable to be

FIG. 7.—A good sweet potato digger. The rolling colter cuts the vines, and the rods projecting from the moldboard aid in freeing the potatoes from the soil and vines.

chilled, thus bringing about favorable conditions for decay in storage. It is important that the potatoes be mature at harvesting time. This can be determined by cutting in half a full-grown potato and allowing the cut surface to be exposed to the sun for half an hour. If the cut surface dries, the potato is mature, but if the sap continues to flow and remains sticky, it is well to postpone the harvesting until the test is favorable.

Careful handling of the potatoes is essential. A satisfactory implement for digging sweet potatoes is a plow with rolling colters for cutting the vines, as shown in figure 7. After the potatoes are dug they should be scratched out by hand and allowed to dry. It is a bad practice to throw several rows of potatoes together, as they will become bruised and be more susceptible to decay. The best plan is to pick up the potatoes direct from the row, place them in crates, and

transport them on a spring wagon to the storage house, where the crates are stacked in the manner already described or the potatoes carefully placed in the bins.

The potatoes should be graded in the field in order to separate the cut and bruised potatoes from the uninjured ones, as this will eliminate extra sorting at the storage house. (Fig. 8.) The cut and bruised potatoes should be disposed of as soon as possible.

CURING.

Before beginning to fill the barn it is a good plan to start the fire a day in advance, so as to dry out the house thoroughly. It should be

FIG. 8.—A sweet-potato field at harvest time. After plowing, the sweet potatoes are scratched out by hand and allowed to dry before being placed in barrels or baskets.

remembered that the furnace and piping in a tobacco-curing barn is designed to maintain a high temperature and that after the wooden floor is installed for the storage of sweet potatoes, considerable caution must be exercised or the building may be set on fire. On bringing in the sweet potatoes the fire should be continued and the ventilators in the floor or roof opened as wide as possible. A temperature of 85° to 90° F., with plenty of ventilation, should be maintained for about 10 days, or until the eyes of the potatoes on the top of the pile turn pink, showing signs of sprouting. This curing process is simply driving the excess moisture from the potatoes by means of heat, which creates air circulation. The temperature inside the storage house during the curing period is warmer than outside,

and as the cool air enters through the wall ventilators, it warms, expands, and rises. As it rises and circulates around the potatoes it expands and takes up moisture and carries its load out through the roof ventilators.

After the curing period the temperature should be gradually reduced to 50° or 55° F. and held at this temperature as nearly as possible through the remainder of the storage period. When the thermometer registers as low as 45° the fire should be started and the temperature raised, keeping the ventilators open. If the temperature runs about 60° the barn should be opened on a cool night until the temperature inside is lowered to the desired point. It is well to give the barn some ventilation every day unless the weather is damp and rainy, when it may be advisable to close all ventilators. The ventilators and fires should be so managed that moisture is not allowed to collect on the interior walls or windows.

SWEET-POTATO VARIETIES.

BIG-STEM JERSEY.

The vines of the Big-Stem Jersey variety are moderately long, 6 to 12 feet. The roots are russet yellow in color, smooth and regular, long fusiform in shape, and may be either veined or smooth; on rich soils they frequently attain large size. The season is medium late. The flesh is yellow and when baked is sweet, dry, and mealy.

YELLOW JERSEY.

The vines of the Yellow Jersey variety are slender, from 6 to 12 feet long, and the foliage is usually smaller that that of the Big-Stem Jersey. The roots are dark russet yellow, long or short fusiform in shape, two types being known to the market, one long and the other very short. The potatoes may be veined or smooth, are usually small to medium in size, and have yellow flesh. When baked the flesh is very dry and mealy, fairly sweet, and of firm texture.

GOLD SKIN.

The foliage of the Gold Skin variety resembles that of the Yellow Jersey very closely, except that there is a tinge of purple at the base of the leaf. The roots are dark russet yellow in color, fusiform in shape, smooth and regular, and with salmon-colored flesh. When baked they are a dark yellow, medium dry and mealy, and very sweet.

TRIUMPH.

The vines of the Triumph variety are coarse, vigorous, and short, being usually 2 to 4 feet long. The leaves are deep shouldered and

green, but with a purple stain at the juncture of the blade and petiole. The roots are medium to long cylindrical in shape, sometimes very irregular, and light yellow to russet yellow in color. The flesh is usually light yellow. When baked it is creamy yellow in color, medium moist to dry, fairly sweet, and firm in texture. This is a popular southern variety for those demanding a dry-fleshed potato.

PORTO RICO.

The Porto Rico variety is probably the most popular moist-fleshed variety grown to-day. The vines are medium to long, stems coarse, reddish purple in color, and the leaves are large in size and green, except that the base of the leaf blades and the veins are purple. The roots are light rose to rose in color, fusiform to globular and irregular in shape, and smooth and often of very large size. The flesh is orange-yellow to salmon and when baked is dark yellow, moist, and very sweet.

NANCY HALL.

The Nancy Hall variety is almost as popular as Porto Rico and has vines of medium length with green stems and leaves, but with a purple stain at the juncture of the leaf and petiole. The roots are yellow tinged with salmon, veined or smooth and regular, fusiform in shape, medium to large in size, and with dark-yellow flesh. When baked this variety is sweet, moist, and soft in texture.

DOOLEY.

The Dooley variety has long vines, some reaching a length of 15 feet; the stems and foliage are green, and the roots are yellow to salmon in color and have dark-orange flesh. The potatoes are often large in circumference, short fusiform in shape, and when baked are soft, sweet, and squashlike.

PUBLICATIONS ON SWEET POTATOES.

For further information on varieties and cultural methods, see Farmers' Bulletin 999, entitled "Sweet-Potato Growing."

For information on storage-house construction, see Farmers' Bulletin 970, entitled "Sweet-Potato Storage."

For information on diseases, see Farmers' Bulletin 1059, entitled "Sweet-Potato Diseases."

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